Does placing children in foster care increase their adult criminality? ☆

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HIGHLIGHTS

- We evaluate the association between foster care during childhood and adult criminality.
- We allow associations to vary by gender and age at initial placement.
- Foster care predicts higher adult criminality for males first placed between ages 13–18.
- We find no significant association for boys who were placed in foster care before age 13.
- We find no significant association for girls placed in foster care.

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ABSTRACT

We evaluate the association between foster care placement during childhood and adult criminality. In contrast to previous studies, we allow associations to vary by gender and age at initial placement. We find that foster care predicts higher adult criminality for males first placed during adolescence (ages 13–18). We find no significant association for boys who were placed in foster care before age 13 and no significant association on the adult criminality of girls. These null findings stand in stark contrast to the poor outcomes reported in earlier work concerning the long-run effects of foster care.

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1. Introduction

Research concerning child welfare, child development and early investments in human capital formation has been in the spotlight among labor economists in recent years (see, e.g., Currie, 2009; Cunha et al., 2010; Almond and Currie, 2011). Current research addresses both the positive question of how to promote efficient investments in human capital (broadly defined) and the normative issue of equality of opportunity. Our paper speaks to the branch of this literature that is concerned with the effects of publicly provided child welfare programs aimed at those perceived as most in need of assistance.

Children and adolescents who become involved in such programs are often burdened by a number of risks that elevate their vulnerability to behavioral and developmental problems. They may have experienced chronic poverty, dysfunctional and disrupted family situations, abuse and neglect. The problems that these children face are known to predispose them to juvenile conduct problems and delinquency that, if not remediated, may persist into adulthood and may also interfere with an efficient accumulation of productive human capital (Loeber and Stouthamer-Loeber, 1986; Widom, 1989; Cunha et al., 2010). Such children present substantial challenges to child welfare providers. These challenges warrant continued development of policy responses to the complex treatment needs of children in the public child welfare system and thorough evaluations of existing services (Nisenbaum, 2013).

The foster care program studied in this paper is one such policy. Foster care is, perhaps, one of the most far-reaching interventions targeted at children who are abused or neglected by their parents or at adolescents engaged in serious anti-social behavior. The use of this type of care has increased dramatically in many Western countries during the past few decades. In the United States, for example, foster care caseloads more than doubled (from 276,000 to 568,000) between 1985 and 1999 (Swann and Sylvester, 2006). In 2006, an estimated 3.6 million American children came in contact with Child Protective Services; more than 300,000 entered out-of-home care, and approximately 510,000 were in out-of-home care (Berger et al., 2009). In Sweden, foster care caseloads went up from 14,000 in 1980 to 29,600 in 2012 (Statistics Sweden, 1982; Socialstyrelsen, 2013). Today, 2.6% of all adolescents in Sweden aged 13 to 17 and 0.6% of all children in Sweden aged 1 to 12 have spent some time in some form of government care (Socialstyrelsen, 2013).[2]

Unfortunately, the empirical policy evaluation literature has not kept pace with this development and in many instances does not provide us with credible empirical evidence concerning the impact of placement in foster care on children's wellbeing and future outcomes. The main challenge faced by researchers is to find a credible comparison group given that foster care is associated with a large number of baseline risks (Berger et al., 2009). To date, few studies have been able to credibly identify a comparison group that at baseline is equally likely to be removed from their families (but are not) as those who are actually removed. Important exceptions include studies by Doyle (2007, 2008), Berger et al. (2009) and Warburton et al. (2014). But more evidence is needed in order to understand which of the two competing goods should receive priority when making policy; child protection or family preservation. Also, researchers need to focus more attention on the potentially heterogeneous responses to placement in out-of-home care, since studies on bereavement and parental separation show differential results for men and women as well as for other subgroups (Appel et al., 2013).

This paper evaluates the association between foster care and adult criminality by comparing children who were placed in foster care after an investigation by the child welfare committee to children who underwent and investigation during the same time period but were not removed from their families. Differences in this association across subgroups of children using data from the Stockholm Birth Cohort Study (SBC) are explored. The SBC data include information on all individuals born in 1953 who were residing in the greater Stockholm metropolitan area in 1963. The SBC contains a rich set of variables concerning individual, family, social and neighborhood characteristics for more than 15,000 individuals. Furthermore, the case files kept by the local social welfare authorities and child welfare committees for each cohort member were manually coded and that information is included in the SBC data. Thus, all cohort members who came in contact with the child welfare committees are identified and much of the information concerning their cases is known. Administrative crime records from the official police registry are also linked to the SBC data.

We find that men who were placed in foster care as children are 10 percentage points (23%) more likely to be convicted of a crime as adults than their investigated but never-placed counterparts. For females the point estimates are not statistically different from zero. Our subsample regressions clearly show that it is boys who are placed in foster care during adolescence (ages 13–18) that account for the association between placement in foster care and adult criminality. For this subgroup, the placed children are on average 25 percentage points (55%) more likely to commit at least one crime as an adult.

To assess the degree to which this strong association might reflect a causal effect, we explore the potential role of selection on unobservable heterogeneity by running the sensitivity analysis proposed by Altonji et al. (2005). This analysis enables us to present a range of point estimates that may be viewed as bounds on the true casual effect, albeit under a set of very specific maintained assumptions. For example, if we assume that selection on unobservables is just as large as that on observables, an estimate of the causal effect of foster care on crime for this subgroup can be bounded between 0.17 (38%) and 0.25 (55%).

In contrast to our results for adolescent boys, we find a null relationship for boys placed at earlier ages and for girls placed at any age, which is good news given the generally poor outcomes one reads about in the literature on foster care. However, our estimates for these smaller subgroups are quite imprecise. So we cannot rule out modest sized effects.

When analyzing subgroups by type of allegation leading to removal investigation, we find a large and statistically significant positive association for adolescent boys investigated due to *own* anti-social behavior, whereas those adolescent boys placed due to parental behavior had substantially *lower* likelihoods of being convicted of crime as compared to their investigated, but not removed, counterparts.

Many of the existing evaluations of placing children in foster care have looked at effects on juvenile delinquency or adult criminality (Vinnerljung et al., 2006; Doyle, 2007, 2008; Vinnerljung and Sallnäs, 2008; Frederiksen, 2012; Warburton et al., 2014). This choice of outcome variable is motivated by the fact that out-of-home care is especially common among children with high risks for future criminal activity. In the United States, roughly 20% of the prison population under age 30, and 25% of all prisoners with prior convictions, spent part of their youth in foster care (Doyle, 2007). For Canada, Warburton et al. (2014) report that the average incarceration rate (at age 19) is more than twice as high for those placed in foster care than for those who were not placed in foster care. For Sweden, Vinnerljung et al. (2006) and Vinnerljung and Sallnäs (2008) report that children placed in out-of-home care were more likely to be convicted of at least one crime between the ages of 21 and 25 than comparable groups that had not been placed in care and in comparison to the population as a whole.

Doyle (2008) presents the perhaps most convincing causal estimates on foster care and crime in a study on the effects of placing abused or neglected children aged 5–15 in foster care in the United States (Illinois) on adult arrests (until age 31). Capitalizing on the random assignment of case workers (investigators) to families, and their idiosyncratic propensities to make removal recommendations, he constructs an investigator fixed effect (similar to Kling's (2006) judge fixed effect), which is used as an instrumental variable for placement in foster care. This instrumental variable technique allows him to estimate the treatment effect for the children at the margin of being removed from their rearing families and to place a causal interpretation to the obtained estimate, i.e., the marginal treatment effect (MTE). He finds that foster care placement increased the arrest rate of the marginal child by 200–300%. He also describes the type of children that were on the margin of placement in order to say something about what types of cases these results are most likely to apply to. These cases involve African Americans, girls and young adolescents. Warburton et al. (2014) find mixed results for Canada; when estimating MTEs using a similar method to Doyle's case investigator fixed effect, they find that foster care placement of adolescents aged 16–18 reduces the rate of incarceration, while the opposite is found when using an across-the-board policy change in the child apprehension rate as an instrument for the propensity to be removed.

Our empirical strategy does not make use of exogenous variation in the placement decision and thus does not lend itself to estimating the type of marginal treatment effects that Doyle (2007, 2008) and Warburton et al. (2014) are able to identify. Instead, we are confined to conditional means comparison of adult convictions between children who were placed in foster care and the children who underwent an

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[2] It is unclear to what extent these trends symptomize underlying changes in child welfare as opposed to changes in child welfare policy. One prominent study finds that increases in female incarcerations and reductions in cash welfare benefits played a dominant role in explaining the expansion of the fostering policy in the U.S. during 1985–2000 (Swann and Sylvester, 2006). Paxson and Waldfogel (2002, 2003) arrive to similar results, i.e., that reduced welfare benefits increase the number of children in foster care.

investigation during the same period but were not placed. This design has been used before by Lawrence et al. (2006) in their prospective study on the effect of foster care on the development of behavior and psychological functioning during childhood and adolescence using longitudinal data from Minnesota ($n = 189$).[3] Under strong assumptions, our OLS identify the average treatment effect on the treated. But rather than claiming that we are identifying a causal effect, we present a range of point estimates that may be viewed as bounds on this effect, albeit under a set of very specific maintained assumptions.

We contribute in at least two ways to the existing literature evaluating the long-term consequences of foster care. First, unlike previous studies, our data comprises placements made over the whole age range, ages 0–18, making it particularly suited for comparing associations across different age groups. Second, distinction is made between those who are placed due to parental behavior (e.g. parental death, neglect, mental illness or abuse) and those who are placed on the grounds of their own behavior (e.g. delinquency, substance abuse or mental illness).

In the next section, we discuss the institutional context surrounding the foster care program that we study. In Section 3, we present the SBC data and provide descriptive statistics. Our baseline regression results are reported in Section 4. Section 5 addresses the concern of omitted variable bias and performs a sensitivity analysis based on the approach outlined in Altonji et al. (2005). This approach is designed to gauge the degree to which estimates based on non-experimental data are sensitive to selection on unobservables. We conclude in Section 6 with a brief summary of our main findings, a comparison with other studies, and a discussion of possible mechanisms through which placement in foster care might affect adult criminality.

2. The Swedish Institutional Context

Since all children in the Stockholm Birth Cohort Study (SBC) were born in 1953, the placements in foster families studied in this paper all took place between 1953 and 1971. In many respects, placement in foster care is quite similar across time and across countries. There are, however, some important differences that should be kept in mind when considering the direct policy relevance of our results, which we will discuss in this section. We focus on changes within Sweden over time and on contemporaneous cross-country comparisons between Sweden, Denmark and the United States.

In Sweden during the 1950's and '60's there were two types of foster care placements: forced placements and private placements (Vinnerljung, 1996). These two categories are still relevant today (Socialstyrelsen, 2013). A forced placement is when the social authorities take legal custody of a child and then place the child in a foster home (as opposed to placing the child in residential care). Private placements are when the parents voluntarily hand over guardianship of their child to a foster family. The social authorities are still involved in these private placements and are legally required to approve the new family. The main difference between forced and private placements is that parents retain custody of their child if the child is placed voluntarily. Otherwise, the child becomes a ward of the state.

The share of forced removals has typically been low in Sweden (Vinnerljung, 1996). Today they account for only 25% of all placements (Socialstyrelsen, 2013). However, during the 1950's and '60's in Sweden, unwed mothers were put under severe pressure to "voluntarily" place their children in foster homes and/or give them up for adoption. This is clearly no longer the case in Sweden today. In the United States, most foster children are placed in state custody, which means that they would be classified as forced placements in the Swedish system.

Reasons for placement fell into two broad categories: (i) parental abuse and neglect, which includes parental substance abuse, parental mental handicap, parental mental illness, child abandonment, physical or sexual abuse, and (ii) the child's own anti-social behavior. These two broad categories are still relevant today both in Sweden and in other countries such as Denmark and the United States. Importantly, it appears that the observable characteristics of those who do get placed in foster care appear to be quite similar across countries and across time (Vinnerljung, 1996; Simkiss et al., 2012).

Another similarity to contemporary fostering policy is the way foster parents were recruited and assigned (Vinnerljung, 1996; Socialstyrelsen, 2013). The foster family could either have a prior connection to the child (e.g., family members, neighbors, friends of the family), they could be volunteers, or they could be recruited by the social services on recommendation by other foster families. Nearly one-third of the foster parents in Wåhlander's (1990) study of foster care in Stockholm during the 1980's had some prior connection to their foster child. Today roughly 40% of the foster children are placed in what the social authorities call kinship care, which includes both relatives and arrangements where neighbors or close friends become foster parents (Socialstyrelsen, 2013). In the United States, 28% of all foster children are living with relatives (U.S. Department of Health and Human Services et al., 2013), while in Denmark it is much less common to be placed in kinship care (Fallesen et al., 2014).

Most foster families in Sweden during the 1950's and '60's were working class or lower middle class. A disproportionate share of foster families was farmers and it was common to send foster children from the cities to stay with foster families in the countryside. Foster families received financial compensation just like they do today.

Overall, the Swedish foster care system of 1950's and 1960's shares many similarities with contemporary fostering policy. However, there has been a shift over time towards the professionalization and certification of foster homes. There has also been a trend towards encouraging contact with the child's biological parents while the child is in foster care. Over time, the stated goals of the foster care program have been expanded from a singular focus on child protection to include family-oriented treatment policies with an eye towards eventual family reunification. In practice, this means that the adoption of foster children by their foster parents (or by anyone else for that matter) is virtually non-existent in Sweden today. But even in our SBC data the share who leave foster care by being adopted is quite small (at most 2.6%).[4] In the United States, 22% of all foster children leave foster care by being adopted (U.S. Department of Health and Human Services et al., 2013).

Another important cross-country difference is the extent to which different countries use foster care as an option for placement of children in state mandated out-of-home care. Currently, 75% of all children in out-of-home care in the United States are placed in foster care, while in Sweden this figure was 68% in 1972 and 60% today, and in Denmark is only 45% (Vinnerljung, 1996; Datta Gupta and Frederiksen, 2012; U.S. Department of Health and Human Services et al., 2013; Socialstyrelsen, 2013). In our SBC data, 42% of placements in out-of-home care are placements in foster care, while smaller municipalities were more dependent on the use of foster families when placing children in out-of-home care (Vinnerljung, 1996).

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[3] Our methodological design is also quite similar in spirit to the paper by Berger et al. (2009) who study the impact of out-of-home placement on child well-being in terms of cognitive skills and behavioral problems. Their paper is, in part, methodological, since they focus as much attention as we do on methods that may help mitigate selection bias. In contrast to earlier work, they find little evidence of a causal effect of out-of-home placement on children's well-being. In related work, Font (2014) estimates the causal impact of kinship placement versus nonrelative foster care on children's well-being. That is, she studies the effect placement type on children's outcomes. She augments the regression methods used in Berger et al. (2009) with IV methods similar to Doyle (2007, 2008). She finds a consistently negative effect of kin placement (relative to non-kin placement), while the results on test scores and behavioral problems are mixed. Datta Gupta and Frederiksen (2012) examine the role of care type (residential care versus foster home) on juvenile delinquency. Their results indicate that foster care may be less detrimental for children's outcomes than residential care.

[4] We say "at most" since the exact timing of events is not always perfectly clear in our data. It could be that some children were first adopted and then later placed in foster care. But most were probably adopted after first being placed in foster care.

The average time spent in foster care also differs across countries. The placed children in our SBC sample spend on average 20.6 months in foster care, whereas the same figure in 2012 was 16.5 months (Socialstyrelsen, 2013). In the United States, foster children currently spend an average of 22.7 months in foster care (U.S. Department of Health and Human Services et al., 2013). In Denmark, the average time spent in foster care is more than 60 months (Datta Gupta and Frederiksen, 2012; Fallesen, 2013). Other relevant aspects of foster care that may differ across time and space include the volume of case-loads, age at first entry into foster care, and the stability of foster care careers (Swann and Sylvester, 2006; Warburton et al., 2014; Fallesen, 2013; Fallesen et al., 2014).

It is important to keep such differences in mind when considering the relevance of our findings for current policy. In particular, we must keep in mind that foster children placed at different times in different foster care systems may potentially lie on different treatment margins. This possibility is a potential threat to the external validity of any foster care policy evaluation study. We return to this discussion and its implications for our findings in the conclusion.

3. Data

We use the Stockholm Birth Cohort Study (SBC) as a sampling frame for the dataset used in this study. The SBC consists of all 15,117 children (7719 men and 7398 women) born in 1953 who were living in the Stockholm metropolitan area as of November 1, 1963. It contains a rich set of variables concerning individual, family, social and neighborhood characteristics.[5]

All 3290 children belonging to the SBC who have come in contact with one of the child welfare committees (CWC) of the Stockholm greater metropolitan area are identified.[6] The CWCs are responsible for the removal investigations of children and the placement process itself. To be included in our CWC sample, a family must have received a formal decision from the CWC concerning the child. That is, the family must have undergone an investigation by the CWC which resulted in a formal decision.[7]

The CWC case files include information from birth up until age 19 on cohort members for whom a decision was taken. The data tell us if a cohort member has spent time in a foster home or in residential care and also how much time they have spent in these out-of-home placements. The data include information on multiple placements over the life-course. They also include the types and number of decisions made concerning each child. Types of decisions include: (i) no warning or action, (ii) warnings to the parents, (iii) in-home assistance to the family, (iv) further supervision/monitoring of the family situation, and (v) out-of-home placement.

Placement in foster care may be due to the fact that the child's parents were deemed unfit, the child was orphaned or abandoned, or the child was found to be in need of special care. From ages 7 to 19, these decisions are also categorized as to whether or not they were made in direct response to parental behavior or to the child's own behavior. Those placed in foster homes due to their own behavior suffered

many times from substance abuse or severe delinquency. The children who received the other type of out-of-home treatment, i.e., residential care, are excluded from the sample, with the exception of those children who were placed in both forms of out-of-home care during their childhood.[8] Their inclusion among the treated is motivated by the fact that the children, before ending up in foster care, in many cases were first placed in residential care due to emergency situations, for assessment, or for shortage of available foster families (Vinnerljung, 1996).[9]

Crime data for each individual in the SBC come from the national police registry. This registry contains records of offenses that lead to an official report to the CWC in Stockholm or to a conviction anywhere in Sweden. These crime data are divided into seven crime categories, including: violent crime or crimes against persons, stealing, fraud, vandalism, traffic crimes that lead to a court conviction (e.g., driving without a license or under the influence of alcohol), narcotic crimes, and other crimes (see Table 1). For each year from 1966 to the first half of 1984 (i.e., when the respondents are ages 13 through 31), there is information on the number of offenses in each of these crime categories as well as the sentence that was received; the 1966 data is actually a summary of all known crimes reported up to and including 1966. Data on juvenile delinquency is collected from the social registry that includes information concerning delinquent acts that resulted in an intervention by the CWC. The general category of delinquent behavior was also recorded. These include: stealing, violent crimes, alcohol abuse or narcotics, and other offenses. Our data on juvenile delinquency are taken *only* from the files held by the CWC and cover ages 7 to 18. Our data on adult criminality (ages 19–31) are taken *only* from the police registry data on convictions.

3.1. Summary statistics

Table 2 displays descriptive statistics for the treated group in column (1) and the comparison group in column (2). Our treatment group comprises children who were investigated by the CWC and then placed in foster care. The comparison group comprises children whose family was investigated by the CWC but who were not placed in foster care (or any other form of out-of-home care). To document how much selection is mitigated by the choice of comparison group we also display the descriptive statistics for the population of nontreated individuals in the Stockholm Birth Cohort Study (SBC) in column (4). Panel A summarizes the outcome measures, panel B the demographic and placement characteristics, and panel C the family background characteristics.

The outcome variables in this study are criminal conviction and prison sentence. Both are measured by a binary variable equal to 1 if the individual has been convicted of a crime or sentenced to prison at least once between the years 1973 and 1984, i.e., between ages 19–31, and 0 if not. Panel A in Table 2 shows that the treatment group does not significantly differ from the comparison group with respect to crime and prison.

Panel B in Table 2 shows that the 573 children who were placed in foster care spent on average 20.6 months in foster care. The stays in foster care are broken down by age periods; early childhood (ages 0–6), elementary school years (ages 7–12), and adolescence (ages 13–18). For simplicity we will refer to these three periods as Periods 1, 2, and 3, respectively. The 2124 non-treated are the children who at some point during childhood came in contact with the CWC but were never removed from their family. When looking separately at subsamples by period of placement the treated are defined as those investigated

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[5] For a complete description of the SBC data see Stenberg and Vågerö (2006) and Stenberg et al. (2007). These data are well documented and are freely available to all researchers. Application forms and codebooks can be found at http://www.stockholmbirthcohort.su.se/.

[6] Registries outside of the Stockholm metropolitan area were not searched. This means that cohort members cannot appear in the registry before having moved in and that they disappear from it once they move out. Of the 15,117 cohort members, 1373 boys and 1353 girls (i.e., 18% of the birth cohort) were not born in the area, but rather moved into the area some time before November 1, 1963. Also, by November 1, 1970, 503 boys and 444 girls (i.e., 6% of the birth cohort) had left the area. For these individuals, data from the social register are (potentially) censored.

[7] Many investigations were initiated by the CWC in response to suspected maltreatment or to the child's own delinquent behavior. Others were initiated on a routine basis after one of the parents died, was incarcerated, suffered from a severe mental illness, or if the family was placed on welfare. As such, not all children who were investigated were under serious threat of being removed from their parents' custody.

[8] Of the 1166 children removed from their families during their childhood 174 spent time in both types of OHC.

[9] Since we do not observe the exact time of removal within each period it is hard to form a definite picture about the sequence of events based on the data. We observe that of the 174 removed children spending time in both types of OHC during their childhood only 28 children spent time in foster care prior to the period of the removal decision and placement into residential care whereas in 53 cases a removal decision and placement in foster care followed after a spell of residential care in the previous period.

Table 1
Adult crime data at extensive margin by crime type.

	Full Stockholm Birth Cohort sample				Child Welfare Committee sample			
	Men (N = 7719)		Women (N = 7398)		Men (N = 2184)		Women (N = 1106)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Any crime	0.21	0.41	0.04	0.20	0.42	0.49	0.14	0.35
Violent crime	0.05	0.23	0.01	0.08	0.14	0.34	0.03	0.18
Theft	0.08	0.27	0.02	0.15	0.19	0.39	0.08	0.27
Fraud offense	0.04	0.20	0.01	0.12	0.11	0.31	0.06	0.24
Traffic offense	0.10	0.29	0.01	0.11	0.20	0.40	0.04	0.19
Narcotic offense	0.03	0.18	0.01	0.09	0.10	0.30	0.03	0.18
Vandalism offense	0.03	0.17	0.00	0.09	0.08	0.27	0.02	0.14
Other offense	0.09	0.28	0.01	0.08	0.20	0.40	0.03	0.17

Traffic offense includes only severe violations of traffic rules leading to a court conviction, e.g., drunk driving, driving without a license, or reckless endangerment.

and initially removed from their family and placed in foster care in that period and the non-treated were investigated in the same period by the CWC but not removed. Roughly 63% of investigations concerning children in their early childhood (Period 1) result in removal and placement in foster care whereas only about 10% of the investigations concerning adolescents (ages 13–18) result in removal. There are more women (46%) in the treatment group than in the comparison group (28%), which should be kept in mind when considering our results, since treated men and women may not be on the same margin of treatment.

Panel C of Table 2 looks at how well the family background characteristics balance across the treatment group and comparison group. All background characteristics reported in C1 are measured over all three age periods. For example, the dummy variable indicating alcoholism among the parents takes on value 1 if there is a note on parental misuse of alcohol in the CWC file in any of the three periods. All variables reported in C2 only apply as background characteristics for the subgroup of children removed during their adolescence, e.g., grades in grade 6, IQ at age 11, father's income in 1963, and delinquent behavior during elementary school years. It is clear from the *t*-test of means comparison in column (3) that the treatment group is a selected group with respect to most of the observed background characteristics and thus controlling for them will be crucial. However, the selection problem is significantly smaller when defining the control group as all never-treated children among the families that have been under the magnifying glass of case workers from CWC than when defining it as all never-treated individuals from the census sample of SBC as is seen when comparing the two different *t*-tests for mean difference in columns (3) and (5) of Table 2.

4. Baseline OLS results

In order to estimate the association between foster care, FC_i, on adult criminal behavior, $Adult\ Crime_i$, we estimate Eq. (1) using OLS[10]:

$$Adult\ Crime_i = \gamma_1 + \alpha_1 FC_i + \gamma_2 Female_i + \alpha_2 Female_{i*} FC_i + X_i\gamma_3 + \varepsilon_i.$$
$$(1)$$

In Table 3, $Adult\ Crime_i$ is a binary variable equal to one if individual *i* has at least one criminal conviction during adulthood and zero otherwise. In Table 4, $Adult\ Crime_i$ is a binary variable equal to one if individual *i* has at least one prison sentence during adulthood and zero otherwise. Here, adulthood refers to ages 19–31 while foster care during

childhood refers to ages 0–18. The estimating equation also includes a female dummy and its interaction with FC_i. Thus, the parameters of interest are α_1 for men and $\alpha_1 + \alpha_2$ for women. We condition on a set of pre-intervention variables, *X*, including various family background and individual characteristics (see panel C in Table 2).

To interpret the estimated coefficient of FC_i as the causal effect of foster care on adult criminality the Conditional Independence Assumption (CIA) needs to hold. This requires that placement in foster care is as good as randomly assigned conditioned on all pre-intervention variables. We acknowledge that CIA in the fostering context is a strong assumption and will, henceforth, refer to the associations between foster care and crime instead of claiming causality. In Section 5, we examine whether a causal estimate can be bounded away from zero with reasonable assumptions concerning selection on unobservable heterogeneity.

Column (1) in Table 3 reports the OLS results for the whole SBC sample without controlling for background characteristics. The first row reports a coefficient of 0.305 suggesting that boys who were placed in foster care have higher crime rates. The mean crime rate for males in this sample is 21%. For girls in this sample, the mean crime rate is roughly 4% and those girls placed in foster care have crime rates that are roughly 11 percentage points higher.

In columns (2) and (3), the comparison group is narrowed down to the CWC sample, i.e., the children who underwent an investigation during their childhood but were never removed from their families. The coefficient on foster care falls to 0.10 for boys and to zero for girls. Defining the comparison group this way should substantially mitigate the usual omitted variable bias in means comparison — that children who are removed come from worse backgrounds and would have worse outcomes regardless of removal. The positive association for boys between foster care and crime still remains both statistically significant and quantitatively important. The mean crime rate for boys in this sample is roughly 43% with those placed in foster care having a roughly 10 percentage point higher rate.

In column (3), the family background characteristics controlled for are based only on the CWC records from Period 1 (see variable list in panel C1 of Table 2). We include 403 neighborhood dummies based on the variable District of residence in 1953 which uses the same geographical division as the tax assessment area, the voting district or parts of the voting district (in total there were 857 districts of residence in the Stockholm Metropolitan area in 1953). Even though the exact time of removal during Period 1 is unknown, we assume that the background characteristics recorded in each period have been collected by the CWC's case worker upon investigating the family and making a placement decision. In this sense, background characteristics derived from records referring to a particular age period are as good as pre-intervention variables for placement decisions made in that age period.

In columns (4)–(7), we split the sample by age period within which the investigation leading to the *initial* removal took place. The children whose case investigation within a particular age period resulted in foster care placement in that period are contrasted with those children who were investigated by case workers within the same age period but for whom the investigation did *not* give rise to removal and consequently no out-of-home-care in that period (or in any other period for that matter). We condition foster care placement in a particular period on *not* having been placed in earlier periods but *allow* the duration of placement to stretch over age periods in the sense that a child placed, for example, at age 11 (Period 2) and who spent all her adolescence until age 18 in foster care will be considered in the subgroup of treated within Period 2. This way we can compare foster care associations with crime across different ages at *initial* placement.

In column (4), those who were placed in foster care during early childhood (ages 0–6) are contrasted to the never-placed within the CWC sample who received a negative placement decision by a case worker in the same age period. In this regression the background variables included remain the same as in column (3), except for the number of neighborhood dummies based on District of residence in 1953, which

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[10] In Table 6, we report results from a probit model for adolescent males and females. Table A3 in the Electronic Appendix replicates the main results in Table 3 using a probit model.

Table 2
Summary statistics.

	Treatment group in registry Child Welfare Committee (CWC)	Comparison group in registry Child Welfare Committee (CWC)	t-Test of mean difference	All nontreated cohort (1953) members in Stockholm Birth Cohort Study (SBC)	t-Test of mean difference
	Mean (SD) or N	Mean (SD) or N	t (p-value)	Mean (SD) or N	t (p-value)
Panel A: Cohort member outcomes					
Crime conviction (1973–1984)	0.34 (0.47)	0.34 (0.47)	0.29 (0.77)	0.11 (0.32)	−19.93 (0.000)
Prison sentence (1973–1984)	0.12 (0.32)	0.10 (0.30)	−1.25 (0.21)	0.03 (0.16)	−15.36 (0.000)
Panel B: Cohort member demographic and placement characteristics					
Female	0.46 (0.50)	0.28 (0.45)	−8.22 (0.000)	0.49 (0.50)	3.50 (0.001)
Removal investigation (foster care), N	573	2124			
<Age 7 (P1)	191*	303			
7 ≤ Age < 13 (P2)	99*	408			
13 ≤ Age < 19 (P3)	182*	1741			
Total time spent in foster care (P1 + P2 + P3) in months, N = 573	20.61 (31.84)				
Adopted	0.026 (0.007)	0.014 (0.003)	−2.10 (0.04)	0.008 (0.001)	−4.68 (0.000)
Panel C: Family background characteristics					
Part C1: Preplacement wrt placement in any period					
Parents' alcoholism	0.19 (0.39)	0.12 (0.32)	−4.31 (0.000)	0.03 (0.18)	−24.88 (0.000)
Parents' drunkenness	0.11 (0.31)	0.06 (0.23)	−4.63 (0.000)	0.03 (0.16)	−10.19 (0.000)
Total received welfare	99.66 (211.75)	64.88 (188.77)	−3.81 (0.000)	22.52 (115.80)	−19.96 (0.000)
Years on welfare	4.12 (4.97)	2.26 (4.11)	−9.16 (0.000)	0.76 (2.39)	−38.84 (0.000)
Welfare (yes = 1)	0.64 (0.48)	0.42 (0.49)	−9.79 (0.000)	0.18 (0.38)	−36.66 (0.000)
Father's mental health disorders (MHD)	0.09 (0.29)	0.06 (0.24)	−2.98 (0.003)	0.02 (0.15)	−14.50 (0.000)
Mother's MHD	0.25 (0.43)	0.09 (0.29)	−9.84 (0.000)	0.03 (0.16)	
Death of father	0.06 (0.24)	0.04 (0.19)	−2.76 (0.006)	0.01 (0.11)	−11.33 (0.000)
Death of mother	0.04 (0.20)	0.02 (0.13)	−3.92 (0.000)	0.00 (0.07)	−13.44 (0.000)
Father in prison	0.05 (0.23)	0.02 (0.15)	−3.65 (0.000)	0.01 (0.10)	−10.31 (0.000)
Finnish origin	0.03 (0.17)	0.02 (0.13)	−1.94 (0.052)	0.01 (0.12)	−3.02 (0.004)

(continued on next page)

is reduced to 168. In column (5), the placed children are those who were initially placed in foster care during Period 2 and the comparisons are the never-placed within the CWC sample who were investigated in the same age period. In our Period 2 regressions, we control for 48 neighborhood dummies based on Parish of residence in 1960 (there were 112 parishes in the Stockholm Metropolitan Area in 1960).

In columns (6) and (7), the foster care variable takes on value one if the child was initially removed as a result of an investigation during Period 3 and zero if not removed. In column (6), additional family background variables are included, e.g., father's income in 1963, number of siblings in 1964, and parent's marital status, recorded in 1964 (see variable list in panel C2 of Table 2). Also important child specific pre-intervention characteristics are included such as IQ test scores and grades in 6th grade as well as 213 neighborhood dummies based on District of residence in 1963, i.e., the tax assessment area or voting districts.[11]

In column (7), an additional background covariate is included, i.e., pre-intervention juvenile delinquency. When controlling for juvenile delinquency we are particularly cautious not to confuse it with post-intervention crime and include only juvenile delinquency recorded during the previous age period, i.e. elementary school years prior to start of high school. Our concern with juvenile delinquency recorded in the same period as removal, namely during Period 3, is that it was not only recorded for removal investigation purposes but also after placement in foster care.

The results in columns (4) and (5) show that the association between foster care placements early on in childhood and adult criminal behavior is not statistically different from zero for either males or females. Columns (6)–(7) show that boys who are placed at ages 13–18 (Period 3) had roughly 25 percentage points (55%) higher adult criminality than their never-placed counterparts. This is a striking contrast to the associations found for the children removed earlier on in childhood. The association for girls who were placed at these ages is not statistically different from zero (p-value: 0.48). Including pre-placement juvenile delinquency in column (7) shrinks the negative association somewhat in comparison to column (6) but does not qualitatively change the results.[12] [13]

Overall, the results in Table 3 suggest that a positive association between placement into foster care and adult criminality exists *but* that only the boys placed during adolescence account for this association. Based on the point estimates of the subgroup regressions for preschoolers (4) and elementary school pupils (5), children placed in foster care at earlier stages of childhood do not seem to fare any worse than their non-placed counterparts in terms of adult criminal behavior. However, interpretation of the subgroup results deserves caution due to the wide confidence intervals; in column (4), at the 95% confidence intervals, slope coefficients between −0.18 and 0.17 cannot be ruled out for men, whereas the range is −0.09 to 0.13 for females. Similarly, in column (5), we cannot rule out slope coefficients between −0.21 and 0.10 for men and −0.17 and 0.14 for women.

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[11] Codebooks II and III of the Stockholm Birth Cohort describe in detail the construction of district of residence and parish division in the Stockholm metropolitan area during the period of observation: http://www.stockholmbirthcohort.su.se/about-the-project/original-data-1953-1983.

[12] We also ran a version of the model in column (7) including both juvenile delinquency recorded in Period 2 and in Period 3. In this regression the coefficient (*standard error*) of foster care fell to 0.242 (*0.051*).

[13] For robustness we run regressions excluding the 174 observations from the CWC sample who had spent time in both foster care and residential care (see footnote 7) during their childhood. The foster care coefficient (*standard error*) is 0.221 (*0.062*) in a regression identical to column (7) in Table 3. We also estimate the identical model for the Period 3 subsample as for the Period 1 and 2 subsamples, i.e., including only the covariates listed in panel C1 of Table 2, the foster care coefficient (*standard error*) is 0.290 (*0.052*).

Table 2 (*continued*)

	Treatment group in registry Child Welfare Committee (CWC)	Comparison group in registry Child Welfare Committee (CWC)	t-Test of mean difference	All nontreated cohort (1953) members in Stockholm Birth Cohort Study (SBC)	t-Test of mean difference
	Mean (SD) or N	Mean (SD) or N	t (p-value)	Mean (SD) or N	t (p-value)
SES in 1953 (0–6)	3.78 (1.39)	3.51 (1.40)	−4.07 (0.000)	3.03 (1.48)	−14.54 (0.000)
Maternal age at birth	26.05 (6.34)	27.84 (5.95)	6.30 (0.000)	28.51 (5.62)	9.51 (0.000)
Crime record by father	0.30 (0.46)	0.21 (0.41)	−4.49 (0.000)	0.11 (0.31)	−15.53 (0.000)
Birth length	41.14 (19.41)	41.27 (19.82)	0.14 (0.887)	40.22 (20.65)	4.29 (0.000)
Birth weight	28.02 (13.61)	28.53 (14.49)	0.75 (0.450)	27.91 (14.99)	2.67 (0.008)
Father's education	0.07 (0.29)	0.15 (0.44)	4.26 (0.000)	0.34 (0.63)	12.62 (0.000)
Mother's education	0.01 (0.12)	0.03 (0.20)	2.73 (0.006)	0.09 (0.34)	6.94 (0.000)
Part C2: Preplacement wrt placement in Period 3					
Number of siblings in 1964	1.40 (1.27)	1.51 (1.21)	1.81 (0.069)	1.36 (1.06)	−4.17 (0.000)
Parents married in 1964	0.66 (0.47)	0.84 (0.36)	9.91 (0.000)	0.91 (0.29)	20.47 (0.000)
Father's income in 1963	3.04 (0.38)	3.10 (0.47)	2.64 (0.008)	3.24 (0.50)	12.26 (0.000)
Delinquent in P2	0.18 (0.39)	0.11 (0.32)	−4.66 (0.000)	0.02 (0.13)	–
Grades in 6th grade	279.90 (61.19)	284.97 (63.38)	1.71 (0.087)	323.46 (68.22)	18.01 (0.000)
Verbal test (IQ)	21.52 (6.09)	22.31 (6.20)	2.73 (0.006)	24.85 (6.65)	16.25 (0.000)
Spatial test (IQ)	20.32 (6.64)	21.27 (6.83)	2.97 (0.003)	22.85 (7.01)	11.06 (0.000)
Numerical test (IQ)	16.92 (6.89)	18.49 (7.61)	4.46 (0.000)	20.93 (8.01)	15.19 (0.000)
Observations	573	2124		13,919	

In panel B, the numbers of investigations ending up with the child being placed in the age groups (marked with an asterisk) do not add up to the total number of placed (all age groups together) because some children have incoherent records for the period where the decision leading to the initial placement took place. For example, 239 children were initially placed in foster care in Period 1 but for only 191 of these we see a positive placement decision recorded in that same period. There are two reasons for this incoherency of which the first being lags between placement and the eventual filing of the decision (e.g., Period 1 decision filed in Period 2) and the second being that some children did not receive a removal decision in the observed period of placement since they switched from foster care (residential care) to residential care (foster care) between periods. These ambiguous cases are excluded from the subsample analyses by age period of initial placement.

We have also investigated the association between foster care and adult criminality by crime type. Table A1 of the Electronic Appendix presents results for the same model shown in column (6) of Table 3 for each of the subcategories of crime listed in Table 1. The results remain qualitatively the same for all subcategories as for any crime. There is no single category of crime driving our results.

In Table 4, we examine the effect of foster care on whether the individual has ever been sentenced to prison up until age 31. The results are by and large in line with the results in Table 3 and show that the overall positive association between foster care and prison seems to be driven by the subsample of adolescent males, although precision of the estimates for other subgroups warrant caution. The association for adolescent males is 0.18, which is equivalent to a 120% increased probability of being sentenced to prison at least once as an adult.

4.1. Placement reason

As discussed earlier, children are investigated by the CWC either because of their own anti-social behavior or because of parental neglect. Even though it may be hard to single out the origin of the problems leading to an investigation, it is likely that children with different social problems also differ in the way they respond to treatment. The CWC files contain a crude categorization on whether the investigation by the case worker was initiated due to the child's own anti-social behavior or due to parental neglect or other family circumstance.

In Table 5, we split the sample into these two categories and replicate column (6) of Table 2 for each subsample.[14] A limitation to this subsample analysis is that most of the investigations concerning adolescents are conducted due to own behavior (in Period 3 only 145 investigations were made due to parental behavior).[15] In order not to further decrease the number of observations, we allow for both the treated

and comparisons to have a placement history prior to Period 3 instead of restricting the analysis to those initially placed in Period 3. Crucially, both the treated and comparisons must have undergone a CWC investigation in Period 3 leading to a placement decision.

Column (1) reports the estimates of the sample pooling both categories of investigations. The point estimate of foster care is smaller in magnitude than the equivalent estimate in column (6) of Table 4, the reason being that this time the comparison group also includes children placed in foster care in earlier periods. Column (2) reports the results for those children investigated due to own delinquent behavior and column (3) reports the results for those investigated due to parental behavior. The point estimates differ dramatically between the two subsamples. Boys who were placed in foster family during adolescence due to own behavior were roughly 22 percentage points more likely to commit crime during adulthood than their counterparts, whereas the probability to commit crime for boys who were placed due to parental behavior was 20 percentage points *lower* than for their counterparts.

An important caveat that warrants mention is that by including previously placed children in the comparison group the results across subsamples may be driven by differential shares of previously treated among the comparisons. In the parental behavior subsample, 9 individuals of the 110 comparisons had been removed and placed in foster care prior to Period 3 whereas only 3.5% of the 1700 comparisons in the own behavior sample had spent time in foster care prior to Period 3 (none of the comparisons in either group had been placed in residential care prior to Period 3). Furthermore, as we have shown in the previous subsections, placement at earlier stages of life does not have a significant effect on criminality. We therefore conclude that the difference in the shares of comparisons removed in earlier periods does not account for the huge difference in the effects between the subsamples.

4.2. Duration of foster care

Placement in foster care has both an extensive and intensive margin. The SBC foster children have spent on average 20.6 months in foster care, but the standard deviation around this mean is substantial

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[14] The reason for not including pre-intervention delinquency is that only very few among those placed due to parental behavior had a record of youth delinquency.
[15] Of all 1436 children investigated due to parental behavior 1049 are investigated the first time at ages 0–6.

Table 3
Foster care and adult crime (OLS).

Dependent variable: Any crime during years 1973–1984	SBC (1)	CWC (2)	CWC (3)	CWC (4)	CWC (5)	CWC (6)	CWC (7)
Foster care (FC)	0.305*** (0.028)	0.101*** (0.031)	0.105*** (0.035)				
Foster care in P1				−0.003* (0.089)			
Foster care in P2					−0.054 (0.077)		
Foster care in P3						0.273*** (0.051)	0.252*** (0.052)
Female	−0.156*** (0.005)	−0.267*** (0.019)	−0.282*** (0.023)	−0.295*** (0.062)	−0.411*** (0.047)	−0.260*** (0.027)	−0.252*** (0.027)
Female*FC	−0.193*** (0.035)	−0.103** (0.040)	−0.103** (0.046)				
Female*FC_P1				0.023 (0.103)			
Female*FC_P2					0.041 (0.106)		
Female*FC_P3						−0.242*** (0.077)	−0.226*** (0.077)
Mean dep. var.							
Females	0.04	0.14	0.14	0.09	0.11	0.19	0.19
Males	0.21	0.43	0.43	0.37	0.48	0.45	0.45
Control for							
Family background			X	X	X	X	X
Preplacement delinquency							X
Neighborhood			X	X	X	X	X
s.e. for $\alpha_1 + \alpha_2$	0.021	0.026	0.027	0.057	0.080	0.057	0.058
Observations	14,523	2696	2696	494	507	1922	1922
R-squared	0.083	0.083	0.240	0.469	0.254	0.200	0.204

The models are estimated by OLS and robust standard errors are reported in parentheses. SBC = whole census sample from Stockholm Birth Cohort 1953; CWC = sample only including removal investigations from SBC. The first three columns define the treated group as the children placed in foster care during their childhood. The last four columns define the treatment group as the children placed for the first time in foster care during a particular age period (P1, P2, or P3) of their childhood. The control group is in each regression the never-placed children who underwent a removal investigation. In columns (4)–(7) they must have been subject to an investigation during the same age period as the treated. Those, who were placed in both foster care and residential care are included as treated whereas those who were only placed in residential care (in columns (4)–(7) within the same age period), are excluded from the analysis. The family background covariates included in columns (3)–(4) are those that are pre-placement variables for all periods (see panel C1 in Table 1 for the list of variables and definitions), and the 404 neighborhood dummies included in (3) and 168 in (4) are based on the 1953 neighborhood of residence codes in SBC. In column (5) pre-placement is defined as having occurred before period P2 (in P2 the list of pre-placement variables remains the same as in panel C1 of Table 1 but is updated in P2) and the 48 neighborhood dummies are based on the 1960 parish codes. In columns (6)–(7) pre-intervention is defined as having occurred before P3 (see panel C1 in Table 1 for variables updated in P3 and panel C2 for variables only available for P3) and the 213 neighborhood dummies are based on the 1963 neighborhood of residence.

*** Indicates significance at 1%.
 ** Indicates significance at 5%.
  * Indicates significance at 10%.

(30.84 months). In a recent Danish study, Fallesen (2013) shows that longer stays in foster care may improve adult outcomes such as income and labor market participation.

We examine the intensive margin of foster care by looking at the association between duration of stay (measured in months) and our crime outcome. The lumpiness of our duration of stay variable (and the relatively small sample size, N = 574) prevents us from analyzing the dose response in detail.[16] We did, however, run a simple linear model regressing our binary outcome for any adult crime against duration of stay in foster care and the complete set of background covariates of panel C1 in Table 2. In addition, we included dummies for period of investigation. The duration of stay coefficient was substantively small and very imprecise; an additional month of foster care decreases the likelihood of committing crime by a mere 0.038 percentage points (p-value = 0.516).

4.3. Statistical power

A concern that arises when dealing with small sample sizes and when failing to detect a significant association between foster care and adult crime, as is the case in the subsample analysis in columns (4) and (5) of Tables 3 and 4, is that low statistical power prevents any potential association of reasonable size to be statistically significant. A power calculation is in this case useful in order to determine whether

our findings of a null association for the younger age groups are informative regarding the absence of a true association.

Our estimates using a two-sided test of size $\alpha = 0.05$ show that our analysis of the association between foster care and crime in the two pre-adolescent age period subsamples is under-powered in the sense that our sample sizes are too small to detect significant true effect size of say 0.10.[17] In the subsample of preschoolers (N = 494), the size of the association would have to be larger than 0.17 to be detected at 1% significance level. In the subsample of elementary school pupils, it would require a sample of roughly 6000 observations to detect an even marginally significant association of 0.05, i.e., the magnitude of the association found in column (6) of Table 3 (and turning the question around, given the 507 observations, a marginally significant association of 0.17 can be detected). These power calculations show that we cannot exclude rather large associations in any of the age subsamples with reasonable confidence. However, it is also clear that associations of the same magnitude as in the adolescent subsample (≈ 0.25) could be detected at 1% significance level in the younger subsamples. In this sense, our results convincingly show that the positive association is at least smaller in the younger age groups as compared to adolescents.[18]

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[16] The duration of stay variable heaps by quarterly intervals.

[17] Our sample power calculations are performed using the Stata module called sampsi_reg.

[18] As for the prison results reported in Table 4, smaller associations can be detected with reasonable confidence: for preschoolers a marginally significant 0.07 association can be detected and for elementary school kids a marginally significant 0.12 association can be detected.

Table 4
Foster care and prison sentence (OLS).

Dependent variable: Prison sentence during years 1973–1984	SBC (1)	CWC (2)	CWC (3)	CWC (4)	CWC (5)	CWC (6)	CWC (7)
Foster care (FC)	0.147*** (0.022)	0.077*** (0.024)	0.075*** (0.028)				
Foster care in P1				0.056 (0.054)			
Foster care in P2					−0.043 (0.063)		
Foster care in P3						0.208*** (0.052)	0.183*** (0.051)
Female	−0.046*** (0.003)	−0.100*** (0.011)	−0.113*** (0.013)	−0.050 (0.036)	−0.182*** (0.032)	−0.101*** (0.016)	−0.092*** (0.016)
Female*FC	−0.140*** (0.023)	−0.091*** (0.026)	−0.075** (0.031)				
Female*FC_P1				−0.095 (0.059)			
Female*FC_P2					0.044 (0.070)		
Female*FC_P3						−0.238*** (0.056)	−0.219*** (0.055)
Mean of dep. var.							
Female	0.003	0.02		0.02	0.01	0.03	
Male	0.06	0.14		0.10	0.17	0.15	
Control for							
Family background			X	X	X	X	X
Preplacement delinquency							X
s.e. for $\alpha_1 + \alpha_2$	0.006	0.009	0.014	0.034	0.038	0.024	0.024
Observations	14,523	2696	2696	494	507	1922	1922
R-squared	0.040	0.039	0.194	0.401	0.146	0.152	0.167

See notes in Table 3.

5. The sensitivity of estimates to correlations in unobservables

Thus far, we have reported a large positive association between placement in foster care and adult criminality for adolescent males and a set of null findings for young boys and for all subgroups of females. But in order to be able to evaluate the foster care policy we need to be able to identify its causal effect on crime. The fundamental difficulty in carrying out a causal analysis of a question like ours using only observational data is that foster care placements are by no means random: kids from worse backgrounds are more likely to be removed from their families and selection on important unobserved factors may affect placement in foster care. In order to take our analysis a bit further than the simple associations between foster care and crime, we run an additional analysis designed to help us judge how sensitive our main OLS results might be to omitted variable bias (OVB). This sensitivity analysis is based on the approach outlined in Altonji et al. (2005).

Before moving to the sensitivity analyses, it is worth pointing out that OVB is already substantially mitigated in the baseline analysis for three particular reasons. First, the choice of control group is *not* the population at large, but rather the group of children whose families had for some reason come in contact with their local child welfare committee (CWC, the agency that determines out-of-home placement). Second, many of the family background variables controlled for in the analysis are derived from the actual file kept by the CWC concerning each child's case and represent key criteria considered by the CWC's investigator when making her placement decision.[19] Third, the path dependent nature of crime makes juvenile crime a strong predictor of adult crime and hence, a particularly strong control for unobservable characteristics.

Table 5
Foster care and adult crime at the extensive margin — regression results for subsample regressions by reason for CWC investigation at ages 13–18 (P3).

Dependent variable: Any crime during years 1973–1984	(1)	(2)	(3)
Foster care in P3 (FC)	0.194*** (0.044)		
Foster care (due to own behavior)		0.223*** (0.044)	
Foster care (due to parental neglect)			−0.203* (0.136)
Female	−0.252*** (0.024)	−0.240*** (0.026)	−0.215** (0.089)
Female*FC	−0.173*** (0.062)		
Female*FC _own		−0.196*** (0.068)	
Female*FC _fam			0.186 (0.148)
Mean dep. var.			
Female	0.19	0.22	0.06
Male	0.45	0.46	0.22
s.e. for $\alpha_1 + \alpha_2$	0.045	0.053	0.074
Observations	2048	1903	145
R-squared	0.101	0.105	0.224

The models are estimated by OLS and robust standard errors are reported in parentheses. Given that only 35 children were placed in foster homes as a consequence of family behavior in P3 (vs. 110 nontreated comparisons), we allow both treated and comparisons to have a placement history prior to P3. The treatment variable takes on value one if being placed in foster care and zero if not placed in either form of out-of-home care in P3 as a consequence of a decision taken in that particular period unconditional on having been placed in out-of-home care prior to P3. Column (2) includes only those who were investigated due to own behavior in P3. Column (3) includes only those who were investigated due to parental neglect in P3. The control variables are the same as in column (6) of Tables 3 and 4 in each regression except for neighborhood dummies that are excluded from all three regressions due to the small number of observations that are placed due to family behavior in relation to the number of neighborhood dummies.
*** Indicates significance at 1%.
 ** Indicates significance at 5%.
  * Indicates significance at 10%.

[19] As Angrist (1998) argues in his paper comparing the earnings and employment status of military service veterans to non-enlisting applicants, knowledge of the screening process and complete information on the characteristics used when screening applicants can eliminate the selection bias induced by the screening when using regression analysis or matching estimators.

The sensitivity analysis is carried out in two steps. The first step tests how sensitive our estimates of α_1 and α_2 are to different assumptions concerning the strength of potential correlations between unobservable factors that affect both placement in foster care and adult criminality. The second step produces new estimates of α_1 and $\alpha_1 + \alpha_2$ under the assumption that selection on unobservables is as strong as the measured degree of selection on observables. Altonji et al. (2005) argue that this later estimate will, in fact, be a lower bound on the true causal impact, while our original estimate acts as an upper bound. Using this approach, we can potentially bound the true causal effect of foster care on adult criminality. For ease of exposition, we run the analysis separately for males and females and denote the coefficient of foster care by α for both sexes.

The Altonji et al. (2005) approach is based on the following bivariate probit model:

$$FC_i = 1\left(FC_i^* > 0\right) \equiv 1\left(X_i'\beta + u_i > 0\right), \tag{2}$$

$$Adult\, crime_i = 1\left(Adult\, crime_1^* > 0\right) \equiv 1\left(\alpha FC_i + X_i'\gamma + e_i > 0\right), \tag{3}$$

$$\begin{bmatrix} u \\ e \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right). \tag{4}$$

Unobservables that affect placement, u, and adult criminality, e, are assumed to be joint normally distributed and correlated by a factor, ρ, where $0 < \rho < 1$. As it stands, the bivariate probit model can be treated as underidentified by one parameter. In order to obtain an estimate of α, the causal impact of foster care on adult criminality, we set a fixed value for ρ before estimating the model. Then we allow the value of ρ to range from 0.0 to 0.4 and record the observed changes in the estimated value of α. These results are reported in Table 6.

Recall that we reported an OLS estimate of placing adolescent males in foster care on the probability of committing crime of 0.25 (0.052) in column (7) of Table 3. The average marginal effect calculated after estimating the bivariate probit model (under the assumption that ρ is equal to zero) is reported in column (1) of Table 6. This new estimate of the average marginal effect is also 0.25 (0.054). In the absence of selection on gains (more on this below), this estimate can be viewed as an upper bound on the true causal effect of foster care, as the Conditional Independence Assumption (CIA) implies that ρ is equal to zero.

When ρ is set equal to 0.2, the average marginal effect of foster care decreases to 0.14 (0.053), but remains significant at the 1% level. At $\rho = 0.3$, the average marginal effect is 0.09 (0.053), but only significant at the 10% level. When ρ increases to 0.4, the average marginal effect is reduced to 0.03 and is no longer statistically significant.

If we set ρ (the degree of selection on unobservables) equal to the degree of selection on observables, i.e. $\rho = \left(\frac{\text{cov}\,(X'\beta, X'\gamma)}{\text{var}\,(X'\gamma)}\right)$, which in this case is at $\rho = 0.15$, then the marginal effect of foster care is still significant and large (17 percentage points or 38%; see column (6) in Table 6). Under a set of relatively strong assumptions, yet arguably more plausible than the CIA, this estimate can be viewed as a lower bound on the causal effect of foster care on adult criminality.

The precise conditions and formal model behind the idea that setting selection on unobservables equal to selection on observables leads to a lower bound of causal estimates of treatment are given in Altonji et al. (2005). Roughly, the assumptions imposed are that (a) the observables are randomly chosen from a full set of factors that determine the outcome variable; (b) the number of observed variables and the number of unobserved variables are large and that none of the elements dominates the distribution of the treatment variable or the outcome; and (c) the regression of latent variable FC_i^* on $Adult\, Crime_i^* - \alpha FC_i$ is equal to the regression of the part of FC_i^* that is orthogonal to X on the corresponding part of $Adult\, Crime_i^* - \alpha FC_i$.

Assumptions (a) and (b) are unlikely to hold exactly in our case, which may affect whether or not we can view the average marginal effect produced by setting $\rho = \left(\frac{\text{cov}\,(X'\beta, X'\gamma)}{\text{var}\,(X'\gamma)}\right)$ as a lower bound on the causal effect. Assumption (a) says that our control variables should be picked at random, which they are not. The social authorities have recorded key factors that have real impact on placement decisions. In turn, we have used this pertinent information as controls. This implies that our estimates in column (6) of Table 6 should be viewed as conservative lower bounds, i.e., $0 \leq \rho \leq \left(\frac{\text{cov}\,(X'\beta, X'\gamma)}{\text{var}\,(X'\gamma)}\right)$.

Assumption (b) states that no key unobservable variable should dominate the placement decision. This assumption may be more plausible in the original Altonji et al. (2005) setting of Catholic school choice than it is here. One could imagine, for example, that a social worker's overall subjective impression of a family and/or situation (tempered with years of experience or lack of experience) weighs in heavily relative to the objective facts that are documented in the case files that we have access to. If this is true, then the logic of the lower bound no longer holds. The social worker's subjective opinion may dominate. However, the role of selection on unobservables would have to be twice as large as that of selection on observables for our estimates to become statistically insignificant and nearly three times as large to push them down to zero.

Table 6
Estimates of the average marginal effect of foster care given different assumptions on the correlation of disturbances in bivariate probit models.

	(1) $\rho = 0$	(2) $\rho = 0.10$	(3) $\rho = 0.20$	(4) $\rho = 0.30$	(5) $\rho = 0.40$	(6) $\rho =$ selection on observables
A: Males ages 13–18						$\rho = 0.15$
Dep. var.: Crime7384	0.252***	N.A.	0.144***	0.087*	0.03**	0.172***
N = 1428	(0.054)		(0.053)	(0.053)	(0.052)	(0.054)
B: Males ages 13–18						$\rho = 0.31$
Dep. var.: Prison	0.126***			0.030	−0.003	0.026
N = 1428	(0.031)	N.A.	N.A.	(0.031)	(0.031)	(0.031)
C: Females ages 13–18						$\rho = 0.21$
Dep. var.: Crime7384	0.073*		0.019	−0.008	−0.035	0.017
N = 494	(0.042)	N.A.	(0.042)	(0.041)	(0.041)	(0.042)

The background covariates included in the bivariate probit model are the same as in column (7) of Tables 3 and 4. The robust variance–covariance matrix is passed on to the *margins* command in STATA using the *vce(unconditional)* option. N.A. indicates that the bivariate probit model did not converge to a solution.
*** Indicates significance at 1%.
 ** Indicates significance at 5%.
  * Indicates significance at 10%.

The Altonji (2005) approach further assumes that the treatment effect is homogenous when holding all observable characteristics constant. This is a strong assumption, but is in keeping with Doyle (2007) who finds relatively linear marginal treatment effects (MTE) for delinquency over the range of propensities of removal. It is at odds though with Doyle (2008) who finds upward sloping MTE estimates for adult criminality over the range of propensity of removal and hence we cannot exclude the possibility of sorting on gain. Sorting on gain – that children with higher expected benefits from foster care placement are more likely to be placed – would bias the OLS estimates in the opposite direction as compared to OVB.

In column (7) of Table 4, we reported a strong association for adolescent males between foster care and having at least one prison sentence (18 percentage points or 120%). In panel B of Table 6, we see that this estimate falls to 13 percentage points (87%) when switching from OLS to the new probit estimator (with $\rho = 0$). We also see that this result appears to be quite sensitive to selection on unobservables. It is no longer statistically significant, nor is it substantively meaningful, if we set ρ such that selection on unobservables is equal to selection on observables (see column (6) of Table 6). This makes it less likely that we are capturing some part of a causal effect.

Lastly, panel C of Table 6 confirms our null finding for adolescent females. It also shows us that selection on unobservables does not appear to be masking a significant protective effect.

6. Conclusion

We use exceptional data from the Stockholm Birth Cohort Study in order to investigate the relationship between placement of children in foster care and their adult criminality. We find a large positive association between foster care and adult criminality for boys first placed during adolescence (ages 13–18). If we assume that selection on unobservables is as large as that on observables, then the causal effect can be bounded between 0.17 (38%) and 0.25 (55%). Selection on unobservables would need to be twice as large as that on observables to make this association statistically insignificant or nearly three times as large to push it down to zero.

In contrast to our result for adolescent boys, we find no relationship for boys who were placed in foster care before age 13 and no association between foster care and adult criminality for girls regardless of when they were placed. However, these null findings are very imprecise, so we cannot reject the existence of modest associations. Results by crime type and for prison are similar to our baseline results for crime. Our results for prison, however, appear to be quite sensitive to selection on unobservables. We also investigated the intensive margin of foster care, but were unable to see any meaningful dose response.

Interestingly, adolescent boys who are placed in foster care for their own protection (from their parents' behavior) appear to have lower average crime rates than their counterparts. The damaging result that we find for foster care on adolescent boys is only accounted for by those boys who are placed in foster care due to their own antisocial behavior.

Our results differ in several respects from those reported in previous studies. Doyle (2008), for example, finds that foster care placement increased the arrest rate of the marginal child by 200–300%. Warburton et al. (2014) find mixed results; both positive and negative effects of foster care on incarceration depending on which IV is used. They argue that a general conclusion on the causal effects of foster care placement may not be possible. They stress that it matters which children are being placed and how they are being taken care of.

The most dramatic difference in results between our study and previous studies is found within the youngest age groups for which we find a zero association (or possibly even a small favorable one), while Doyle (2008) finds large adverse effects. The difference in the subpopulation for which the effect is identified is likely to explain why our findings differ. The always takers (i.e., the most obvious cases for which all investigators would recommend removal) among the younger age groups have presumably large beneficial effects of removal in relation to the compliers and thus may contribute disproportionately to our average treatment effect on the treated estimate, while this group doesn't contribute at all to Doyle's (2008) marginal treatment effect estimates. Also, since Sweden uses foster care as a form of out-of-home placement to a lesser extent than the United States does (both historically and today), the marginal child in each country may lie on a different margin of treatment. For example, it could be possible that the most difficult Swedish cases end up in residential care as opposed to being placed in foster care in the United States.

We did not find any significant dose-responses of the duration of foster care. This is at odds with Fallesen (2013), who finds a beneficial causal effect of foster care at the intensive margin of care. Our analysis, however, is far from ideal. Our sample is relatively small compared to Fallesen's (2013) and our time in foster care variable tends to heap by quarterly intervals. Furthermore, average placement lengths in Fallesen's (2013) Danish sample are more than twice as long as those in our Swedish sample. So, an additional month in our exercise may not be addressing the same margin of treatment as an additional month in his exercise.

Ideally, one would like to know through which mechanisms being placed in foster care might affect the incentives facing adults. Foster care challenges caregiving relationships by definition through family disruption. Some children experience parental separation as significant rejection or loss, which may add to the burden of inadequate care and adverse conditions that these children already share at baseline (Bowlby, 1960, Lawrence et al., 2006). The adverse effects we find for adolescent boys could also reflect weaknesses within the system as such; it is unclear how well equipped the foster parents were with tools for dealing with the elevated behavior problem levels manifested in adolescent boys at baseline. The support and training services provided to foster parents may not always be adequate and break-downs of fostering relationships are quite common for adolescents (Wåhlander, 1990; Vinnerljung, 1996).

Another question that arises is whether a switch from an urban environment to a rural one reinforced the trauma of parental separation or whether it was beneficial since it may have offered children a fresh start in terms of school and peers. Fahnsell and Shinn (1978) found that the children who were able to maintain their ties to their rearing family while in foster care had better prospects of reunification with their rearing families after foster care. In most cases, placement in a rural environment coincided with placement to non-relatives (Wåhlander, 1990).

We are also concerned about the educational outcomes of these children. Replacing *Adult Crime$_i$* with *Years of Schooling$_i$* in our model, results in an estimated 0.7 years of less schooling. Although this is an important difference, it is not large enough to explain an adverse effect size of 0.17 to 0.25.[20]

At this point, and with these data, we can only speculate about the mechanisms underlying the adverse effects that we find. We can also stress (once again) the importance of our null findings, given that most previous, non-causal studies of foster care find that treated children do so poorly when looking at their adult outcomes. We argue that these earlier findings are mainly due to the fact that many of these studies lacked proper control groups and had access to only a limited set of control variables.

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[20] Assuming that the coefficient −0.7 is the true causal impact of foster care on years of schooling and based on the result that the causal impact of one more year of schooling on crime is −0.022 (Hjalmarsson et al., forthcoming), then 0.7 x 0.022 = 0.0154 percentage points, which is a rather small number in this context.

Taken together, our results suggest that foster care may be a more effective policy tool (less counter-effective) when it is directed to children in their early stages of life and towards girls. The behavioral problems of adolescent boys, on the other hand, appear to be exacerbated by placement in foster care, resulting in more adult criminality. Enhanced awareness of potentially differential consequences of foster care depending on gender, age at first placement, and reason for placement may motivate policy makers to develop and test more targeted interventions and will hopefully encourage future researchers to delve into the underlying mechanisms.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.labeco.2014.10.001.

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